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Everybody here knows that asthma is some major public health problem. In fact, it's the most common chronic respiratory disease in children. The cost of the disease, direct and indirect, is enormous, near \$16 billion on this data from 10 years ago. When you look at data by ethnicity or race, African Americans appear to have the greatest prevalence, morbidity, or mortality from asthma, much higher than whites.

And then if you look at Hispanics, there's somewhere in the middle, is substantial lower than African Americans, but that such finding is a fallacy. So Hispanic is a term coined by the US census. If you go to Latin America and you ask-- you tell people, you're Hispanic, they want to know what you're talking about.

So the US census came up with this term and as is stated, it refers to people whose roots can be traced to any country or territory that was previously under Spanish domain. So it does not refer to race. This is very confusing to people.

So here you have five people who would check Hispanic in the US census, Rigoberta Menchu, who's a Mayan Indian from Guatemala. She won the Nobel Peace Prize. You have two players from my previous favorite team, of course, I root for the Pirates, but the Red Sox, Mike Lowell, who's Puerto Rican of Cuban descent. He's probably predominantly European. And then you have Papi Ortiz, who is retiring this year, and he's obviously predominantly African descent. He's Dominican.

Alberto Fujimori is Peruvian, so he will be Hispanic, but his parents are Japanese. And then you have Shakira, who is from my hometown, Barranquilla, Colombia, and is half Lebanese, half Colombian. So for biomedical research purposes, this is a mess. To use any data that refers to Hispanic is really nearly useless except in certain context.

Once you look at this in more detail, this is what US Hispanic or Latinos look like. So about 2/3 are of Mexican descent. That's logical since that's a neighboring country. Then you have 9% who are Puerto Ricans. I think that confuses a lot of people, and what some people really don't know is that Puerto Ricans are US citizens.

This is one of the last colonies in the world. The US gained the Puerto Rico territory in the 1898 War. Puerto Rico is not a State, it's not a country, it's just a territory. So if you travel there, you don't need a passport.

4% are Cuban, then you have 13% who are Central and South American. And you have this interesting box, others. So others include Dominicans, Spaniards, and also a lot of people don't know this, Hispanics who have been in what's now the US since the 1500s.

So if you Google the Geological Society of New Mexico, you'll find people in Bernalillo County, near Albuquerque, who have been there for nearly 400 years, and they speak still Spanish dialect, which sounds very much like Spanish from the 16th century. For those of you who are fans of Anthony Bourdain, if you YouTube that, you can see program, a show he did in New Mexico, and he has a family like that, this Spanish from New Mexico.

Now, once you take this into account, a completely different picture emerges. Puerto Ricans have actually the greatest burden of asthma in this nation, whether you look at prevalence, morbidity, or mortality. African Americans rank second, and then the group with the lowest burden is Mexicans. This is this so-called Hispanic paradox that we and many others have demonstrated.

You observe these paradoxical findings for COPD as well. You see it for premature birth. So Puerto Rican women deliver the most preemies, and Mexican women, the fewest. You do not see this for obesity and diabetes, where both groups are heavily affected.

So why do we have these disparities in [INAUDIBLE] asthma across ethnic or racial groups? It has to do with factors at the individual level and also factors at the community level. So at the individual level, you have some things we can not change, like genetics and ancestry. But the rest of all these things are theoretically modifiable, including socioeconomic status, pollutants in the home, environmental tobacco, perhaps, we don't know, vitamin D, stress and violence, which is what I'm going to talk about today, of course, access to care, literacy, cultural beliefs.

And then on the community level, you have some of the same things. Now you have outdoor pollutants and also violence in the communities.

So here is a picture of a fort called El Morro. If you ever go to San Juan, it's beautiful, really nice place to visit. And one thing about Puerto Ricans is they are also highly exposed to violence, where they're leaving the island. And 5% of the population has left the island for the mainland over the last 10 years. This was in CNN. And one of the factors is unemployment, but the other one is crime and violence.

When they move here, unfortunately, some of them live in communities with high rates of violence such as the Bronx where I did my internship; or Philadelphia; Lawrence, Massachusetts; Hartford, Connecticut. Not only are they exposed to high levels of violence, but they appear to be highly susceptible to detrimental effects of violence.

So if you look at data of veterans of the Vietnam War, the ethnic group with the highest incidence of PTSD is Puerto Ricans. Following the events of 9/11, the ethnic group that reported the most PTSD symptoms in New York was Puerto Ricans. So interestingly enough, stress and violence have been linked to asthma and asthma morbidity over the last 20 years, and we've conducted a series of studies on this topic

So this will be data from children, adults, so I'll indicate where it's kids or adults as I move on. So it's the first study that we published in 2008. We had a population-based sample of children 6 to 14 in San Juan and Caguas. This is in Puerto Rico. And we had data on exposure to violence and physical or sexual abuse, which are data very, very difficult to collect for a number of reasons.

So 14% of the kids that witnessed an act of violence, 7% have been direct victims of violence, and 6% have been victims of physical or sexual abuse in the year prior to the study. And what we found in the study was that physical or sexual abuse in the previous year, after accounting for family history and any indicators of socioeconomic status, health insurance, was associated with greater rates of asthma, allergic outcomes, medication used for asthma. I'm not showing it here, but also ED visits and hospitalizations for asthma.

Now, this was the first report of an association between abuse and childhood asthma. And at the time, we thought that perhaps it had to do with alterations of cortisol or metabolism, the HbA access. At the time, this study was cross-sectional, so you have this phenomenon of chicken and egg. So you could come back to me and say, Dr. Celedon, but what's happening is that these kids are sickly, and therefore, they are more likely to be abused. That's a valid critique.

However, a few years later, an independent group led by Coogan did a study on African American women in their 20s, and they were questioned about abuse as girls. Those who had a history of physical abuse, had a higher risk of developing asthma over a 10-year period of follow up.

So twin data. Some of you are too young to know who this woman is, but some will know as Jane Seymour, she of *Medicine Woman* fame on TV. So she has twins. And you can use twins to study genetics. You can use twins for many purposes. Lately we've been using them to study epigenetics. I won't talk about that today.

But this is a very nice study that my colleague, Glorisa Canino, in Puerto Rico, scull prince. This is not a random sample. Every single pair of twins born in Puerto Rico in 2006 was recruited in this study. This was not ascertained. The kids did not enter this study on the face of any family history, so it's random sample.

But what was very, very unique about this study is that we interviewed both the mother, which most studies do, but also the father. The father is neglected in a lot of these studies, but we interviewed him separately. The father went to a separate room and answered questions.

And then the twins were followed from birth to age three years. And these are some of the characteristics of 339 times 2 is 678. We had about a third or more were zygotic, or identical twins. The rest were dizygotic twins. There is a high prevalence of parental asthma suspected in Puerto Rico.

And most kids were categorized as having any income below the medium, about 63%. In this sort of data, the number of parents who were interviewed about paternal PTSD, the median score was 1%, which is relatively low, and some other data here.

But the important thing is that several indicators, so paternal psychosocial stress or illness were positively associated with symptoms in the kids, symptoms of asthma at age one year, including paternal PTSD, major depression, antisocial behavior, depressive symptoms in the mother, and depression in either parent was very strongly and significantly associated with asthma symptoms in the babies.

So in addition, we show that maternal depression was associated with hospitalizations on any visits when the babies turned three, and parental depression was associated with use of steroids and hospitalizations. So this was a longitudinal study.